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Santa Margarita Lake
San Luis Obispo County, California

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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NATIONAL EUTROPHICATION SURVEY

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REPORT

ON

SANTA MARGARITA LAKE
SAN LUIS OBISPO COUNTY
CALIFORNIA

EPA REGION IX

WORKING PAPER No. 756

WITH THE COOPERATION OF THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

AND THE

CALIFORNIA NATIONAL GUARD

MARCH, 1978

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentration (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the California State Water Resources Control Board and the nine Regional Water Quality Control Boards for professional involvement, to the California National Guard for conducting the tributary sampling phase of the Survey, and to those California wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staff of the Division of Planning and Research of the State Water Resources Control Board provided invaluable lake documentation and counsel during the Survey, coordinated the reviews of the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

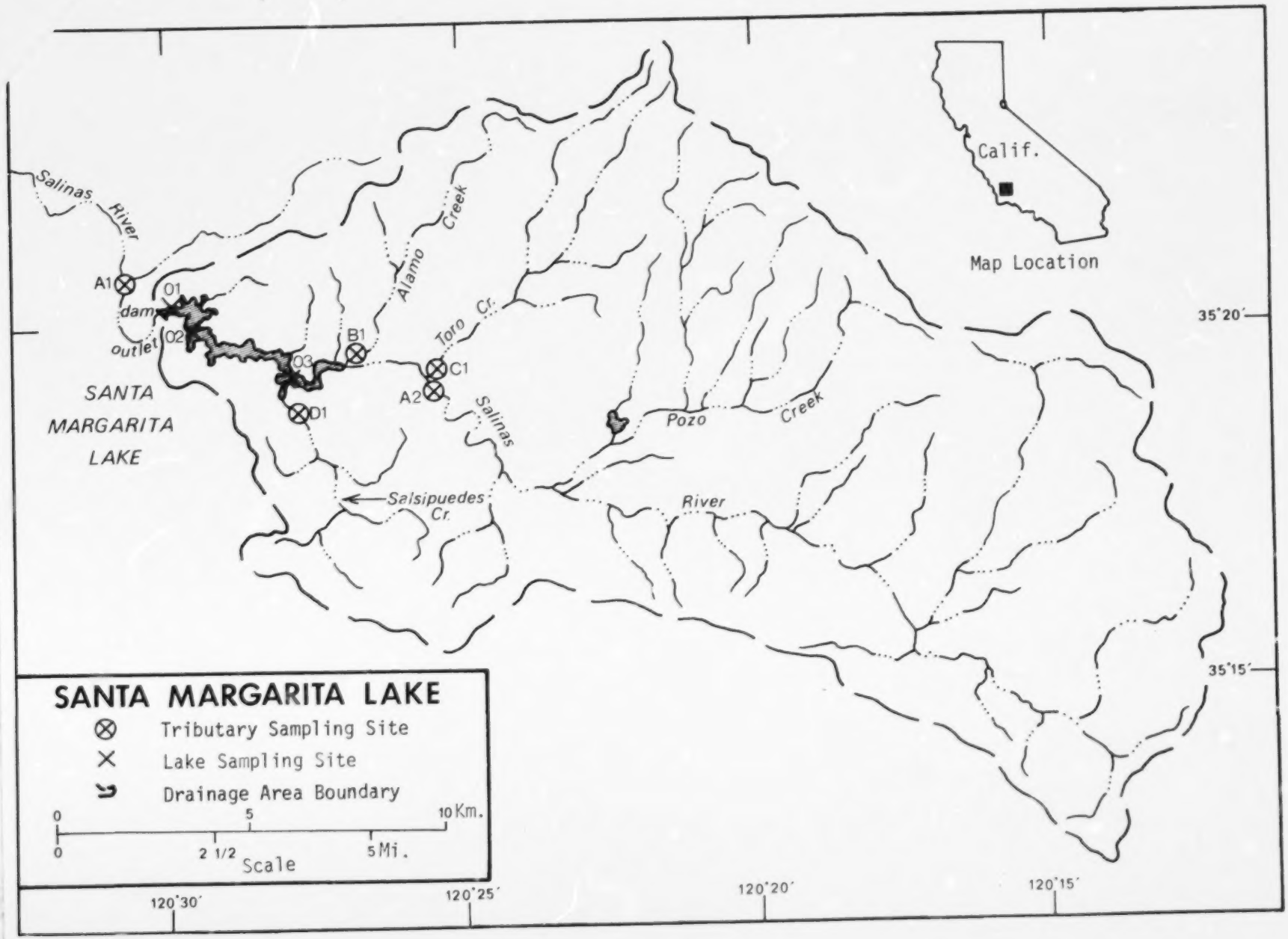
Major General Glen C. Ames, the Adjutant General of California, and Project Officer Second Lieutenant Terry L. Barrie, who directed the volunteer efforts of the California National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of California

Name	County
Amador	Amador
Boca	Nevada
Britton	Shasta
Casitas	Ventura
Crowley	Mono
Don Pedro	Tuolumne
Elsinore	Riverside
Fallen Leaf	El Dorado
Hennessey	Napa
Henshaw	San Diego
Iron Gate	Siskiyou
Lopez	San Luis Obispo
Mary	Mono
Mendocino	Mendocino
Nicasio	Marin
Lower Otay	San Diego
Pillsbury	Lake
Santa Margarita	San Luis Obispo
Shasta	Shasta
Shaver	Fresno
Silver	Mono
Tahoe	El Dorado, Placer, CA; Carson City, Douglas, Washoe, NV
Tulloch	Calaveras, Tuolumne
Lower Twin	Mono
Upper Twin	Mono


Salinas River
A1
O1
dam
outlet
O2
O3
O1
B1
Alamo Creek
Toro Cr.
C1
A2
Salinas
Pozo
Creek
River
Salsipuedes Cr.
SANTA MARGARITA LAKE
Calif.
Map Location
35°20'
35°15'
120°30'
120°25'
120°20'
120°15'
SANTA MARGARITA LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0
5
10 Km.
0
2 1/2
5 Mi.
Scale

SANTA MARGARITA LAKE

STORET NO. 0620

I. CONCLUSIONS

A. Trophic Condition*:

Survey data indicate that Santa Margarita Lake is eutrophic. It ranked sixteenth in overall trophic quality when the 24 California lakes and reservoirs sampled in 1975 were compared using a combination of six parameters**. Fourteen of the water bodies had less median total phosphorus, 15 had less and one had the same median inorganic nitrogen, 14 had less and one had the same median dissolved orthophosphorus, 18 had less mean chlorophyll a, and 11 had greater mean Secchi disc transparency. Significant decreases in dissolved oxygen with depth occurred at all three sampling stations in June and at stations 1 and 2 in November; and hypolimnetic depression is reported to occur during summer stratification (Bailey, 1977).

Survey limnologists noted emergent macrophytes along much of the shoreline but did not observe any surface concentrations of algae.

Fish kills and phytoplankton are reported to be problems in the reservoir (Johns, 1975).

B. Rate-Limiting Nutrient:

The results of the algal assay indicate nitrogen limitation in November. The reservoir data indicate nitrogen limitation all three sampling times.

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* Trophic assessment is based on the levels of nutrients, dissolved oxygen and chloropnyll a; phytoplankton, kinds and numbers; and transparency (Allum et al., 1977).

** See Appendix A.

C. Nutrient Controllability:

1. Point sources--No known municipal wastewater treatment plants impacted Santa Margarita Lake during the sampling year. Septic tanks serving shoreline recreational facilities were estimated to have contributed 0.3% of the total phosphorus load, but a shoreline survey would have to be done to determine the significance of those sources.

The present phosphorus loading of 0.48 $g/m^2/yr$ is only a little less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11). However, considering the lack of point sources and the low phosphorus export rates of the tributaries (see below), it does not seem likely the loading can be reduced appreciably.

2. Non-point sources--Non-point sources, including direct precipitation, contributed 99.7% of the total phosphorus load. The Salinas River added 40.0% of the total; Toro Creek, 8.4%; and the ungaged minor tributaries and immediate drainage contributed an estimated 47.7%.

The phosphorus export rates of the Salinas River and Toro Creek were 3 and 5 $kg/km^2/yr$, respectively (see page 10).

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 3.18 kilometers^2.
2. Mean depth: 10.1 meters.
3. Maximum depth: 39.6 meters.
4. Volume: 32.107 x 10^6 m^3.
5. Mean hydraulic retention time: 1.6 years.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Salinas River	182.1	0.501
Toro Creek	24.8	0.017
Minor tributaries & immediate drainage -	80.0	0.229
Totals	286.9	0.747

2. Outlet -

Salinas River	290.1**	0.646**

C. Precipitation***:

1. Year of sampling: 84.3 centimeters.
2. Mean annual: 77.6 centimeters.

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† Table of metric conversions--Appendix B.
†† Dendy, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of reservoir; lesser outflow due to evaporation.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Santa Margarita Lake was sampled three times in 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at three stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 30.2 meters at station 1, 21.3 meters at station 2, and 11.0 meters at station 3.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR SANTA MARGARITA LAKE
STORET CODE 0620

PARAMETER	1ST SAMPLING (3/10/75) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (6/25/75) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (11/12/75) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	7.9 - 11.8	9.9	9.3	8.3 - 21.2	16.2	20.1	9.3 - 14.1	12.1	13.1
DISS OXY (MG/L)	4.0 - 10.4	7.5	7.0	0.2 - 8.0	4.8	7.2	1.0 - 8.4	5.2	7.0
CNDCTVY (MCROMO)	275. - 298.	287.	286.	290. - 420.	367.	410.	230. - 309.	275.	282.
PH (STAND UNITS)	7.6 - 8.7	8.0	7.9	7.7 - 8.2	8.0	8.0	7.3 - 8.1	7.7	7.9
TOT ALK (MG/L)	112. - 122.	117.	116.	114. - 138.	130.	131.	125. - 141.	130.	128.
TOT P (MG/L)	0.020 - 0.054	0.030	0.029	0.018 - 0.158	0.054	0.031	0.041 - 0.306	0.127	0.077
ORTHO P (MG/L)	0.005 - 0.020	0.010	0.010	0.003 - 0.111	0.026	0.010	0.013 - 0.200	0.067	0.026
NO2+NO3 (MG/L)	0.020 - 0.070	0.032	0.020	0.020 - 0.190	0.043	0.020	0.020 - 0.020	0.020	0.020
AMMONIA (MG/L)	0.040 - 0.130	0.076	0.080	0.020 - 0.310	0.068	0.030	0.020 - 0.490	0.130	0.020
KJEL N (MG/L)	0.200 - 0.900	0.447	0.400	0.300 - 0.600	0.400	0.400	0.200 - 1.400	0.500	0.400
INORG N (MG/L)	0.060 - 0.180	0.107	0.110	0.040 - 0.430	0.111	0.060	0.040 - 0.510	0.150	0.040
TOTAL N (MG/L)	0.240 - 0.920	0.479	0.470	0.320 - 0.720	0.443	0.420	0.220 - 1.420	0.520	0.420
CHLRPYL A (UG/L)	7.1 - 17.5	12.0	11.4	1.8 - 3.5	2.7	2.8	5.9 - 25.1	12.7	7.0
SECCHI (METERS)	****** -**********			2.4 - 2.6	2.5	2.6	****** -**********		

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/10/75	1. *Asterionella sp.*	4,920
	2. *Cryptomonas sp.*	109
	Total	5,029
06/25/75	1. *Mougeotia sp.*	2,181
	2. *Synedra sp.*	488
	3. *Dinobryon sp.*	163
	4. *Anabaenopsis sp.*	130
	5. *Oscillatoria sp.*	130
	Other genera	98
	Total	3,190
11/12/75	1. *Dactylococcopsis sp.*	304
	2. *Ceratium sp.*	152
	3. *Stephanodiscus sp.*	122
	4. *Dinobryon sp.*	91
	5. *Glenodinium sp.*	61
	Other genera	121
	Total	851

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/10/75	1	11.4
	2	17.5
	3	7.1
06/25/75	1	1.8
	2	2.8
	3	3.5
11/12/75	1	5.9
	2	25.1
	3	7.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.090	0.155	8.0
0.050 P	0.140	0.155	8.4
0.050 P + 1.0 N	0.140	1.155	17.3
1.0 N	0.090	1.155	18.8

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Santa Margarita Lake was high at the time the sample was collected (11/12/75). Also, the significant growth response when nitrogen was added alone, and the lack of response with the addition of only phosphorus, indicate nitrogen limitation.

The reservoir data indicate nitrogen limitation all three sampling times. The mean inorganic nitrogen to orthophosphorus ratios were 11 to 1 in March, 4 to 1 in June, and 2 to 1 in November.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the California National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v). Sampling was begun in November, 1974, and was completed in November, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the California District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in Alamo Creek at station B-1 and the mean annual ZZ flow.

No known municipal wastewater treatment plants impacted Santa Margarita Lake during the sampling year.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Salinas River	615	40.0
Toro Creek	130	8.4
b. Minor tributaries & immediate drainage (non-point load) -	735	47.7
c. Known municipal STP's - None	-	-
d. Septic tanks* -	5	0.3
e. Known industrial - None	-	-
f. Direct precipitation** -	55	3.6
Total	1,540	100.0

2. Outputs -

Reservoir outlet - Salinas River 935

3. Net annual P accumulation - 605 kg.

* Estimate based on 6 picnic areas; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Salinas River	4,090	31.2
Toro Creek	385	3.0
b. Minor tributaries & immediate drainage (non-point load) -	4,970	38.0
c. Known municipal STP's - None	-	-
d. Septic tanks* -	210	1.6
e. Known industrial - None	-	-
f. Direct precipitation** -	3,435	26.2
Total	13,090	100.0

2. Outputs -

Reservoir outlet - Salinas River 14,135

3. Net annual N loss - 1,045 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Salinas River	3	21
Toro Creek	5	16

E. Nutrient Concentrations in Ungaged Stream:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Alamo Creek	0.102	0.683

* Estimate based on 6 picnic areas; see Working Paper No. 175.
** See Working Paper No. 175.

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.48	0.19	4.1	loss*

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Santa Margarita Lake:

"Dangerous" (eutrophic loading)	0.52
"Permissible" (oligotrophic loading)	0.26

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the reservoir, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, or unsampled point sources discharging directly to the reservoir. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's former National Eutrophication and Lake Restoration Branch (Malueg et al., 1975).

V. LITERATURE REVIEWED

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APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
0601	AMADOR RESERVOIR	0.040	0.390	408.667	22.383	14.600	0.020
0602	BOCA LAKE	0.012	0.040	372.833	1.700	6.800	0.003
0603	LAKE BRITTON	0.067	0.115	448.500	4.811	11.200	0.047
0604	CASITAS RESERVOIR	0.029	0.050	400.250	3.192	14.000	0.014
0605	CROWLEY LAKE	0.046	0.045	374.750	5.800	12.200	0.034
0606	DON PEDRO RESERVOIR	0.013	0.060	381.733	3.564	11.400	0.004
0607	LAKE ELSINORE	0.469	0.120	489.214	70.572	8.000	0.092
0608	FALLEN LEAF RESERVOIR	0.007	0.040	24.357	0.786	8.800	0.005
0609	LAKE HENNESSEY	0.027	0.060	416.000	4.525	15.000	0.012
0610	LAKE HENSHAW	0.138	0.070	461.000	26.783	9.800	0.073
0611	IRON GATE RESERVOIR	0.184	0.690	440.333	6.217	13.800	0.124
0614	LOPEZ LAKE	0.371	0.090	372.000	8.658	15.000	0.343
0615	LAKE MARY	0.010	0.040	296.000	2.550	10.600	0.002
0616	LAKE MENDOCINO	0.020	0.050	436.500	3.100	9.400	0.008
0617	NICASIO RESERVOIR	0.055	0.345	482.778	6.633	9.800	0.013
0618	LOWER OTAY RESERVOIR	0.058	0.180	447.250	15.933	15.000	0.013
0619	LAKE PILLSBURY	0.022	0.060	466.667	6.389	8.200	0.008
0620	SANTA MARGARITA LAKE	0.037	0.070	400.000	9.122	14.800	0.014
0621	SHASTA LAKE	0.021	0.060	381.542	4.087	9.000	0.015
0622	SHAVER	0.014	0.060	346.400	1.700	7.400	0.004
0623	SILVER LAKE	0.012	0.055	356.000	1.800	7.000	0.003
0624	TULLOCK RESERVOIR	0.025	0.060	433.000	13.878	7.400	0.009
0625	UPPER TWIN LAKES	0.015	0.040	300.200	3.340	7.400	0.004
0626	LOWER TWIN LAKES	0.014	0.040	248.000	2.900	11.400	0.003

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NU
0601	AMADOR RESERVOIR	35 (8)	4 (1)	43 (10)	9 (2)	17 (4)	26 (6)	134
0602	BOCA LAKE	89 (20)	98 (22)	70 (16)	91 (21)	100 (23)	91 (20)	539
0603	LAKE BRITTON	17 (4)	22 (5)	17 (4)	48 (11)	43 (10)	17 (4)	164
0604	CASITAS RESERVOIR	43 (10)	74 (17)	48 (11)	70 (16)	22 (5)	37 (8)	294
0605	CROWLEY LAKE	30 (7)	78 (18)	65 (15)	43 (10)	30 (7)	22 (5)	268
0606	DON PEDRO RESERVOIR	83 (19)	54 (11)	57 (13)	61 (14)	37 (8)	78 (17)	370
0607	LAKE ELSINORE	0 (0)	17 (4)	0 (0)	0 (0)	78 (18)	9 (2)	104
0608	FALLEN LEAF RESERVOIR	100 (23)	87 (19)	100 (23)	100 (23)	70 (16)	70 (16)	527
0609	LAKE HENNESSEY	48 (11)	54 (11)	39 (9)	52 (12)	4 (0)	52 (12)	249
0610	LAKE HENSHAW	13 (3)	33 (7)	13 (3)	4 (1)	54 (12)	13 (3)	130
0611	IRON GATE RESERVOIR	9 (2)	0 (0)	26 (6)	39 (9)	26 (6)	4 (1)	104
0614	LOPEZ LAKE	4 (1)	26 (6)	74 (17)	26 (6)	4 (0)	0 (0)	134
0615	LAKE MARY	96 (22)	87 (19)	91 (21)	83 (19)	48 (11)	100 (23)	505
0616	LAKE MENDOCINO	65 (15)	70 (16)	30 (7)	74 (17)	61 (14)	63 (14)	363
0617	NICASIO RESERVOIR	26 (6)	9 (2)	4 (1)	30 (7)	54 (12)	46 (10)	169
0618	LOWER OTAY RESERVOIR	22 (5)	13 (3)	22 (5)	13 (3)	4 (0)	46 (10)	120
0619	LAKE PILLSBURY	57 (13)	41 (9)	9 (2)	35 (8)	74 (17)	63 (14)	279
0620	SANTA MARGARITA LAKE	39 (9)	33 (7)	52 (12)	22 (5)	13 (3)	37 (8)	196
0621	SHASTA LAKE	61 (14)	54 (11)	61 (14)	57 (13)	65 (15)	30 (7)	328
0622	SHAVER	78 (18)	41 (9)	83 (19)	96 (22)	87 (19)	78 (17)	463
0623	SILVER LAKE	89 (20)	65 (15)	78 (18)	87 (20)	96 (22)	91 (20)	506
0624	TULLOCK RESERVOIR	52 (12)	54 (11)	35 (8)	17 (4)	87 (19)	57 (13)	302
0625	UPPER TWIN LAKES	70 (16)	98 (22)	87 (20)	65 (15)	87 (19)	78 (17)	485
0626	LOWER TWIN LAKES	74 (17)	87 (19)	96 (22)	78 (18)	37 (8)	91 (20)	463

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	0602	BOCA LAKE	539
2	0608	FALLEN LEAF RESERVOIR	527
3	0623	SILVER LAKE	506
4	0615	LAKE MARY	505
5	0625	UPPER TWIN LAKES	485
6	0626	LOWER TWIN LAKES	463
7	0622	SHAVER	463
8	0606	DON PEDRO RESERVOIR	370
9	0616	LAKE MENDOCINO	363
10	0621	SHASTA LAKE	328
11	0624	TULLOCK RESERVOIR	302
12	0604	CASITAS RESERVOIR	294
13	0619	LAKE PILLSBURY	279
14	0605	CROWLEY LAKE	268
15	0609	LAKE HENNESSEY	249
16	0620	SANTA MARGARITA LAKE	196
17	0617	NICASIO RESERVOIR	169
18	0603	LAKE BRITTON	164
19	0614	LOPEZ LAKE	134
20	0601	AMADOR RESERVOIR	134
21	0610	LAKE HENSHAW	130
22	0618	LOWER OTAY RESERVOIR	120
23	0607	LAKE ELSINORE	104
24	0611	IRON GATE RESERVOIR	104

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR CALIFORNIA 09/24/76

LAKE CODE 0620 SANTA MARGARITA

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 290.1

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
0620A1	290.1	1.444	1.416	1.416	0.906	0.040	0.173	0.167	0.085	0.130	0.040	0.017	0.396	0.645
0620A2	203.3	1.642	1.586	1.246	0.765	0.110	0.048	0.020	0.011	0.011	0.014	0.079	0.481	0.521
0620C1	24.3	0.042	0.054	0.040	0.017	0.008	0.006	0.006	0.006	0.003	0.006	0.008	0.011	0.017
0620ZZ	83.1	0.753	0.725	0.561	0.354	0.051	0.020	0.008	0.006	0.006	0.006	0.034	0.218	0.229

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 290.1
SUM OF SUB-DRAINAGE AREAS = 290.0

TOTAL FLOW IN = 8.97
TOTAL FLOW OUT = 6.23

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0620A1	11	74	0.014	16	0.014				
	12	74	0.057	8	0.020				
	1	75	0.178	4	0.176				
	2	75	0.011	2	0.065				
	3	75	0.011	2	0.003				
	5	75	0.176	3	0.003				
	6	75	0.263	1	0.453				
	7	75	0.680	28	0.003				
	9	75	0.011	6	0.0				
0620A2	11	74	0.040	16	0.028				
	12	74	0.082	8	0.071				
	1	75	0.062	4	0.065				
	2	75	0.425	2	1.104				
	3	75	0.595	2	0.119				
	5	75	0.119	3	0.252				
	6	75	0.071	1	0.059				
	7	75	0.025	28	0.020				
	9	75	0.011	6	0.008				
0620C1	11	74	0.023	16	0.025				
	12	74	0.023	8	0.011				
	1	75	0.020	4	0.020				
	2	75	0.028	2	0.133				
	3	75	0.025	2	0.017				
	5	75	0.014	3	0.020				
	6	75	0.008	1	0.011				
	7	75	0.006	28	0.006				
	9	75	0.008	6	0.006				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/09/24

062001
35 15 00.0 120 30 01.0 3
SANTA MARGARITA LAKE
06079 CALIFORNIA

140491

11EPALES 2111202
0100 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/03/10	13	35 0000	11.5	9.8		296	8.60	112	0.050	0.900	0.020K	0.014
	13	35 0005	11.2	9.8		295	8.60	113	0.050	0.700	0.020K	0.011
	13	35 0015	10.8	9.0		293	7.90	112	0.060	0.500	0.020K	0.010
	13	35 0030	9.3	7.0		286	7.90	114	0.070	0.500	0.020	0.009
	13	35 0050	8.9	6.4		283	7.80	121	0.080	0.500	0.040	0.011
	13	35 0065	8.5	6.4		280	7.80	116	0.070	0.400	0.050	0.010
	13	35 0080	8.0	6.0		275	7.80	116	0.080	0.300	0.060	0.017
	13	35 0096	7.9	6.0		275	7.80	122	0.100	0.400	0.070	0.020
75/06/25	09	45 0000	20.4	8.0	102	410	8.10	125	0.020	0.400	0.020K	0.015
	09	45 0005	20.3	7.6		410	8.10	125	0.020	0.400	0.020K	0.004
	09	45 0015	20.1	8.0		410	8.10	126	0.020K	0.400	0.020K	0.004
	09	45 0035	10.6	0.4		300	8.00	114	0.030	0.300	0.070	0.007
	09	45 0065	8.7	0.2		290	7.90	119	0.050	0.300	0.190	0.023
	09	45 0099	8.3	0.6		290	7.80	129	0.310	0.600	0.120	0.094
75/11/12	13	20 0000	13.2	7.4		282	7.95	128	0.020	0.400	0.020K	0.015
	13	20 0005	13.1	7.0		295	7.90	128	0.020K	0.400	0.020K	0.014
	13	20 0015	13.1	6.8		294	7.85	126	0.020K	0.200	0.020K	0.019
	13	20 0035	12.5	4.0		283	7.50	128	0.020	0.200	0.020K	0.041
	13	20 0045	9.9	1.4		250	7.35	125	0.120	0.400	0.020K	0.061
	13	20 0070	9.4	1.0		255	7.30	135	0.430	0.600	0.020K	0.177
	13	20 0091	9.3	1.0		243	7.30	134	0.490	0.700	0.020K	0.137

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/09/24

062001
35 15 00.0 120 30 01.0 3
SANTA MARGARITA LAKE
06079 CALIFORNIA
140491

11EPALES 2111202
0100 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/03/10	13 35	0000	0.032	11.4	
	13 35	0005	0.029		
	13 35	0015	0.021		
	13 35	0030	0.021		
	13 35	0050	0.025		
	13 35	0065	0.025		
	13 35	0080	0.027		
	13 35	0096	0.035		
75/06/25	09 45	0000	0.029	1.8	
	09 45	0005	0.018		
	09 45	0015	0.020		
	09 45	0035	0.018		
	09 45	0065	0.034		
	09 45	0099	0.146		
75/11/12	13 20	0000	0.045	5.9	
	13 20	0005	0.043		
	13 20	0015	0.041		
	13 20	0035	0.081		
	13 20	0045	0.132		
	13 20	0070	0.296		
	13 20	0091	0.266		

STORET RETRIEVAL DATE 76/09/24

062002
35 19 54.0 120 29 20.0 3
SANTA MARGARITA LAKE
06079 CALIFORNIA

140491

11EPALES 2111202
0074 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/03/10	14 30	0000	11.8	10.4		298	8.70	116	0.050	0.500	0.020K	0.005
	14 30	0005	11.5	10.0		297	8.70	117	0.040	0.400	0.020K	0.006
	14 30	0015	11.0	8.2		294	7.90	117	0.050	0.500	0.020K	0.005
	14 30	0030	9.3	6.2		283	7.90	118	0.080	0.300	0.020	0.006
	14 30	0050	8.6	5.6		280	7.90	120	0.090	0.200	0.040	0.011
	14 30	0070	8.2	5.2		279	7.80	122	0.120	0.300	0.060	0.012
75/06/25	10 30	0000	20.1	8.0	102	415	8.00	133	0.030	0.300	0.020	0.006
	10 30	0005	20.5	8.0		415	8.20	133	0.030	0.300	0.020K	0.003
	10 30	0015	20.3	7.2		410	8.00	131	0.030	0.400	0.020K	0.005
	10 30	0035	10.4	0.8		300	7.80	129	0.040	0.300	0.020K	0.019
	10 30	0058	8.9	1.0		290	7.70	136	0.170	0.500	0.040	0.061
75/11/12	13 00	0000	14.1	7.8		278	8.05	125	0.020K	0.400	0.020K	0.016
	13 00	0005	13.2	7.6		291	8.00	128	0.020K	0.300	0.020K	0.020
	13 00	0015	13.2	7.6		309	7.90	125	0.020K	0.300	0.020K	0.040
	13 00	0035	12.1	2.2		263	7.40	133	0.220	0.500	0.020	0.163
	13 00	0045	9.8	2.0		230	7.30	136	0.360	0.600	0.020K	0.200
	13 00	0062	9.6	2.0		244	7.30	141	0.370	0.700	0.020K	0.163

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/03/10	14 30	0000	0.037	17.5	
	14 30	0005	0.035		
	14 30	0015	0.029		
	14 30	0030	0.021		
	14 30	0050	0.025		
	14 30	0070	0.036		
75/06/25	10 30	0000	0.028	2.8	
	10 30	0005	0.030		
	10 30	0015	0.031		
	10 30	0035	0.039		
	10 30	0058	0.156		
75/11/12	13 00	0000	0.052	25.1	
	13 00	0005	0.046		
	13 00	0015	0.066		
	13 00	0035	0.222		
	13 00	0045	0.261		
	13 00	0062	0.306		

STORET RETRIEVAL DATE 76/09/24

002003
35 19 18.0 120 27 50.0 3
SANTA MARGARITA LAKE
06079 CALIFORNIA

140491

11EPALES 2111202
0039 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/03/10	15 10	0000	11.7	9.4		295	8.30	116	0.060	0.500	0.020K	0.006
	15 10	0005	11.6	9.2		295	8.20	115	0.090	0.600	0.020	0.015
	15 10	0015	11.0	7.4		293	7.70	116	0.090	0.400	0.020	0.009
	15 10	0025	9.3	6.0		282	7.70	117	0.080	0.300	0.030	0.008
	15 10	0035	8.8	4.0		282	7.60	117	0.130	0.300	0.030	0.007
75/06/25	11 05	0000	21.2	7.8	96	420	8.00	135	0.040	0.500	0.020K	0.010
	11 05	0005	21.1	7.6		420	8.20	136	0.030	0.400	0.020K	0.005
	11 05	0015	20.9	7.0		420	8.00	134	0.040	0.400	0.020K	0.018
	11 05	0036	10.7	0.2		310	7.90	138	0.160	0.500	0.020K	0.111
75/11/12	12 45	0000	13.8	8.4		301	8.05	133	0.020K	0.400	0.020K	0.021
	12 45	0005	13.5	8.4		290	8.10	132	0.020K	1.400	0.020K	0.019
	12 45	0015	13.1	7.4		291	7.95	127	0.020K	0.500	0.020K	0.026
	12 45	0033	12.6	7.2		274	8.00	128	0.020K	0.500	0.020K	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/03/10	15 10	0000	0.054	7.1	
	15 10	0005	0.048		
	15 10	0015	0.029		
	15 10	0025	0.025		
	15 10	0035	0.020		
75/06/25	11 05	0000	0.029	3.5	
	11 05	0005	0.037		
	11 05	0015	0.042		
	11 05	0036	0.158		
75/11/12	12 45	0000	0.066	7.0	
	12 45	0005	0.086		
	12 45	0015	0.066		
	12 45	0033	0.077		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/09/24

0620A1
35 20 45.0 120 30 32.0 4
SALINAS RIVER
06 SAN LUIS OBISPO
O/SANTA MARGARITA LAKE 140491
PILITAS CRK RD BRDG 5.6 M SE S MARGARITA
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/16	09 40		0.012	0.300	0.055	0.005	0.010
74/12/08	13 20		0.008	0.250	0.008	0.013	0.025
75/01/04	10 35		0.008	1.400	0.020	0.010	0.020
75/02/02	09 20		0.056	0.600	0.008K	0.040	0.100
75/03/02	14 00		0.008	0.600	0.024	0.008K	0.020
75/05/03	10 00		0.010	0.100	0.015	0.100	0.140
75/06/01	09 45		0.005	0.100	0.020	0.005	0.020
75/07/28	14 00		0.015	1.650	0.025	0.020	0.050
75/09/06	10 45		0.010	0.700	0.045	0.020	0.050
75/11/01	09 20		0.015	1.100	0.015	0.015	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/09/24

062042
35 19 18.0 120 25 25.0 4
SALINAS RIVER
06 7.5 S MRGRITA LK
T/SANTA MARGARITA LAKE 140491
BNK OFF UNPVD RD 2.0 MI NW PIPPIN CORNER
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/16	10 45		0.008	0.200	0.025	0.020	0.040
74/12/08	14 30		0.008	0.100K	0.022	0.024	0.030
75/01/04	11 20		0.008	0.100K	0.005	0.015	0.020
75/02/02	10 10		0.256		0.016		
75/03/02	14 40		0.040	0.200	0.008	0.016	0.030
75/05/03	10 50		0.005	0.075	0.015	0.020	0.050
75/06/01	11 00		0.005	0.550	0.030	0.021	0.021
75/07/28	14 50		0.010	0.550	0.040	0.030	0.070
75/11/01	10 00		0.010	0.200	0.010	0.020	0.050

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/09/24

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                                                    0423401
                                                    35 14 50.0 120 26 22.0 4
                                                    ALAMO CREEK
                                                    06        7.5 S MRGHITA LK
                                                    1/SANTA MARGARITA LAKE    140491
                                                    UNPVD RD 8406 3.5 MI NW OF PIPPIN CORNER
                                                    11EPALES                  2111204
                                                    3000 FEET  DEPTH  CLASS 00
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DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
75/02/02	10 20		0.368	1.050	0.008K	0.035	0.220
75/03/02	15 00		0.008	0.600	0.016	0.024	0.040
75/05/03	10 40		0.010	0.050K	0.015	0.015	0.040
75/06/06	11 40		0.015	0.650	0.035	0.035	0.116

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/09/24

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 06204
35 19 23.0 120 25 20.0 4
TORO CREEK
06       7.5 S MARGRITA LK
T/SANTA MARGARITA LAKE   140491
SW OFF UNPVD RD 2.4 MI NW PIPPIN CORNER
FEMALES                  2111204
0000 FEET  DEPTH  CLASS 00
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DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/16	10	35	0.012	0.200	0.015	0.095	0.110
74/12/08	14	00	0.056	1.600	0.037	0.113	0.150
75/01/04	11	15	0.064	0.400	0.015	0.075	0.105
75/02/02	10	00	0.200	1.600	0.032	0.290	0.900
75/03/02	14	50	0.024	0.800	0.024	0.096	0.150
75/05/03	10	30	0.010	0.150	0.010	0.100	0.150
75/06/01	10	45	0.010	0.450	0.025	0.145	0.180
75/07/28	14	45	0.005	0.400	0.010	0.220	0.270
75/09/05	11	30	0.005	0.500	0.075	0.160	0.210
75/11/01	09	55	0.010	0.700	0.015	0.110	0.190